INDIANA DEPARTMENT of EDUCATION

2023 INDIANA ACADEMIC STANDARDS

SCIENCE

GRADE 2

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Indiana Academic Standards Context and Purpose

Introduction

The Indiana Academic Standards for Grade 2 Science are the result of a process designed to identify, evaluate, synthesize, and create high-quality, rigorous learning expectations for Indiana students.

Pursuant to Indiana Code (IC) 20-31-3-1(c-d), the Indiana Department of Education (IDOE) facilitated the prioritization of the Indiana Academic Standards. All standards are required to be taught. Standards identified as essential for mastery by the end of the grade level are indicated with the word “Essential” under the standard number.

The Indiana Academic Standards are designed to ensure that all Indiana students, upon graduation, are prepared with essential knowledge and skills needed to access employment, enrollment, or enlistment leading to service.

What are the Indiana Academic Standards and how should they be used?

The Indiana Academic Standards for Grades K-12 Science are based on *A Framework for K-12 Science Education* (NRC, 2012) and the Next Generation Science Standards (NGSS Lead States, 2013). The following conceptual shifts reflect what is new about these science standards. The Indiana Academic Standards for Science:

- Reflect science as it is practiced and experienced in the real world;
- Build logically from kindergarten through grade 12;
- Focus on deeper understanding as well as application of content; and
- Integrate practices, crosscutting concepts, and core ideas.

The K-12 Science Indiana Academic Standards outline the knowledge, science, and engineering practices that all students should learn by the end of high school. The standards are three-dimensional because each student performance expectation engages students at the nexus of the following three dimensions:

- **Dimension 1** describes scientific and engineering practices.
- **Dimension 2** describes crosscutting concepts, overarching science concepts that apply across science disciplines.
- **Dimension 3** describes core ideas in the science disciplines.

Science and Engineering Practices (*as found in NGSS*)

The eight practices describe what scientists use to investigate and build models and theories of the world around them or that engineers use as they build and design systems. The practices are essential for all students to learn and are as follows:

1. Asking questions (for science) and defining problems (for engineering);
2. Developing and using models;

3. Planning and carrying out investigations;
4. Analyzing and interpreting data;
5. Using mathematics and computational thinking;
6. Constructing explanations for science and designing solutions for engineering;
7. Engaging in argument from evidence; and
8. Obtaining, evaluating, and communicating information.

Crosscutting Concepts (*as found in NGSS*)

The seven crosscutting concepts bridge disciplinary boundaries and unit core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas, and develop a coherent, and scientifically based view of the world. The seven crosscutting concepts are as follows:

1. *Patterns.* Observed patterns of forms and events guide organization and classification, and prompt questions about relationships and the factors that influence them.
2. *Cause and Effect: Mechanism and Explanation*. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
3. *Scale, Proportion, and Quantity.* In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
4. *Systems and System Models.* Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.
5. *Energy and Matter: Flows, Cycles, and Conservation.* Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
6. *Structure and Function.* The way in which an object or living thing is shaped and its substructure determines many of its properties and functions.
7. *Stability and Change.* For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Disciplinary Core Ideas (*as found in NGSS*)

The disciplinary core ideas describe the content that occurs at each grade or course. The K-12 Science Indiana Academic Standards focus on a limited number of core ideas in science and engineering both within and across the disciplines and are built on the notion of learning as a developmental progression. The Disciplinary Core Ideas are grouped into the following domains:

- Physical Science (PS)
- Life Science (LS)
- Earth and Space Science (ESS)

- Engineering, Technology and Applications of Science (ETS)

While the Indiana Academic Standards establish key expectations for knowledge and skills and should be used as the basis for curriculum, the standards by themselves do not constitute a curriculum. It is the responsibility of the local school corporation to select and formally adopt curricular tools, including textbooks and any other supplementary materials, that align with Indiana Academic Standards. Additionally, corporation and school leaders should consider the appropriate instructional sequence of the standards as well as the length of time needed to teach each standard. Every standard has a unique place in the continuum of learning, but each standard will not require the same amount of time and attention. A deep understanding of the vertical articulation of the standards will enable educators to make the best instructional decisions. These standards must also be complemented by robust, evidence-based instructional practices to support overall student development. By utilizing strategic and intentional instructional practices, other areas such as STEM and employability skills can be integrated with the content standards.

Acknowledgments

The Indiana Department of Education appreciates the time, dedication, and expertise offered by Indiana's K-12 educators, higher education professors, representatives from business and industry, families, and other stakeholders who contributed to the development of the Indiana Academic Standards. We wish to specially acknowledge the committee members, as well as participants in the public comment period, who dedicated many hours to the review and evaluation of these standards designed to prepare Indiana students for success after graduation.

References

- National Research Council. 2012. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press. https://doi.org/10.17226/13165.
- NGSS Lead States. 2013. *Next Generation Science Standards: For States, By State*s. Washington, DC: The National Academies Press.

How to Read the Indiana Academic Standards for K-12 Science

Standard Number	**Title**	The title for a set of performance expectations is not necessarily unique and may be reused at several different grade levels.

Students who demonstrate understanding can:

Standard Number **Essential**	**Performance Expectation: A statement that combines practices, core ideas, and crosscutting concepts together to describe how students can show what they have learned.** [Clarification Statement: A statement that supplies examples or additional clarification to the performance expectation.]

Science and Engineering Practices

Science and Engineering Practices are activities that scientists and engineers engage in to either understand the world or solve the problem.

There are 8 practices. These are integrated into each standard. They were previously found at the beginning of each grade level content standard and known as SEPs.

Connections to the Nature of Science

Connections are listed in either practices or the crosscutting concepts section.

Disciplinary Core Ideas

Disciplinary Core Ideas are concepts in science and engineering that have broad importance within and across disciplines as well as relevance in people's lives.

To be considered core, the ideas should meet at least two of the following criteria and ideally all four:

- Have broad importance across multiple sciences or engineering disciplines or be a key organizing concept of a single discipline.
- Provide a key tool for understanding or investigating more complex ideas and solving problems.
- Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge.
- Be teachable and learnable over multiple grades at increasing levels of depth and sophistication.

Disciplinary ideas are grouped in four domains: the physical sciences; the life sciences; the earth and space sciences; and engineering, technology, and applications of science.

A disciplinary core idea is identified as "(secondary)" when the other featured disciplinary core ideas connect to the science and engineering practices and crosscutting concepts as the main focus of the performance expectation.

A boundary statement, where applicable, provides guidance regarding the scope of a performance expectation.

Crosscutting Concepts

Crosscutting concepts are seven ideas such as Patterns and Cause and Effect, which are not specific to any one discipline but cut across them all.

Crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas.

Connections to Engineering, Technology and Applications of Science

- These connections are drawn from either the Disciplinary Core Ideas or Science and Engineering Practices.

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.

2-PS1-1 Matter and Its Interactions

Students who demonstrate understanding can:

2-PS1-1 **Essential**

Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]

Science and Engineering Practices

SEP.3: Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.

Crosscutting Concepts

CC.1: Patterns

- Patterns in the natural and human designed world can be observed.

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.

2-PS1-2 Matter and Its Interactions

Students who demonstrate understanding can:

2-PS1-2 **Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.** [Clarification Statement: Examples of properties could include strength, flexibility, hardness, texture, and absorbency.]

Essential

Science and Engineering Practices

SEP.4: Analyzing and Interpreting Data

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Analyze data from tests of an object or tool to determine if it works as intended.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Different properties are suited to different purposes.

Crosscutting Concepts

CC.2: Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

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Connections to Engineering, Technology, and Applications of Science

Influence of Engineering, Technology, and Science, on Society and the Natural World

- Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.

2-PS1-3 Matter and Its Interactions

Students who demonstrate understanding can:

2-PS1-3 **Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

Science and Engineering Practices

SEP.6: Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Different properties are suited to different purposes.
- A great variety of objects can be built up from a small set of pieces.

Crosscutting Concepts

CC.5: Energy and Matter

- Objects may break into smaller pieces and be put together into larger pieces or change shapes.

2-PS1-4 Matter and Its Interactions

Students who demonstrate understanding can:

2-PS1-4 **Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.** [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]

Science and Engineering Practices

SEP.7: Engaging in Argument from Evidence

Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s).

- Construct an argument with evidence to support a claim.

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Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science searches for cause-and-effect relationships to explain natural events.

Disciplinary Core Ideas

PS1.B: Chemical Reactions

- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

Crosscutting Concepts

CC.2: Cause and Effect

- Events have causes that generate observable patterns.

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.

2-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

2-LS2-1 **Plan and conduct an investigation to determine if plants need sunlight and water to grow.**

Essential

Science and Engineering Practices

SEP.3: Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Plants depend on water and light to grow.

Crosscutting Concepts

CC.2: Cause and Effect

- Events have causes that generate observable patterns.

2-LS2-2 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

2-LS2-2 **Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.**

Science and Engineering Practices

SEP.2: Developing and Using Models

Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a simple model based on evidence to represent a proposed object or tool.

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Plants depend on animals for pollination or to move their seeds around.

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. *(secondary)*

Crosscutting Concepts

CC.6: Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.

2-LS4-1 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

2-LS4-1 **Essential**

Make observations of plants and animals to compare the diversity of life in different habitats. [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.]

Science and Engineering Practices

SEP.3: Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Make observations (firsthand or from media) to collect data which can be used to make comparisons.

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Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world.

Disciplinary Core Ideas

LS4.D: Biodiversity and Humans

- There are many different kinds of living things in any area, and they exist in different places on land and in water.

Crosscutting Concepts

CC.2: Cause and Effect

- Events have causes that generate observable patterns.

2-ESS1-1 Earth's Place in the Universe

Students who demonstrate understanding can:

2-ESS1-1

Use information from several sources to provide evidence that Earth events can occur quickly or slowly. [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.]

Science and Engineering Practices

SEP.6: Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations from several sources to construct an evidence-based account for natural phenomena.

Disciplinary Core Ideas

ESS1.C: The History of Planet Earth

- Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.

Crosscutting Concepts

CC.7: Stability and Change

- Things may change slowly or rapidly.

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.

2-ESS2-1 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-1 **Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.** [Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]

Science and Engineering Practices

SEP.6: Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Compare multiple solutions to a problem.

Disciplinary Core Ideas

ESS2.A: Earth Materials and Systems

- Wind and water can change the shape of the land.

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. *(secondary)*

Crosscutting Concepts

CC.7: Stability and Change

- Things may change slowly or rapidly.

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Connections to Engineering, Technology, and Applications of Science

Influence of Engineering, Technology, and Science on Society and the Natural World

- Developing and using technology has impacts on the natural world.

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Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

- Scientists study the natural and material world.

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.

2-ESS2-2 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-2 **Develop a model to represent the shapes and kinds of land and bodies of water in an area.**

Science and Engineering Practices

SEP.2: Developing and Using Models

Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a model to represent patterns in the natural world.

Disciplinary Core Ideas

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- Maps show where things are located. One can map the shapes and kinds of land and water in any area.

Crosscutting Concepts

CC.1: Patterns

- Patterns in the natural world can be observed.

2-ESS2-3 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-3 **Obtain information to identify where water is found on Earth and that it can be solid or liquid.**

Essential

Science and Engineering Practices

SEP.8: Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question.

Disciplinary Core Ideas

ESS2.C: The Roles of Water in Earth's Surface Processes

- Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.

Crosscutting Concepts

CC.1: Patterns

- Patterns in the natural world can be observed.

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.

K-2-ETS1-1 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-1 **Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.**

Science and Engineering Practices

SEP.1: Asking Questions and Defining Problems

Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.

- Ask questions based on observations to find more information about the natural and/or designed world(s).
- Define a simple problem that can be solved through the development of a new or improved object or tool.

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

- A situation that people want to change or create can be approached as a problem to be solved through engineering.
- Asking questions, making observations, and gathering information are helpful in thinking about problems.
- Before beginning to design a solution, it is important to clearly understand the problem.

K-2-ETS1-2 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-2 **Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.**

Science and Engineering Practices

SEP.2: Developing and Using Models

Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a simple model based on evidence to represent a proposed object or tool.

Disciplinary Core Ideas

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Crosscutting Concepts

CC.6: Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.

K-2-ETS1-3 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-3 **Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

Science and Engineering Practices	Disciplinary Core Ideas
SEP.4: Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. ● Analyze data from tests of an object or tool to determine if it works as intended.	**ETS1.C: Optimizing the Design Solution** ● Because there is always more than one possible solution to a problem, it is useful to compare and test designs.

Note: Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts appear as defined in the Next Generation Science Standards.